

What is claimed:

1. An air sweeping system for removing debris from a surface, the system comprising:

a head assembly having a main chamber for debris pick-up having an outlet portion; a nozzle configured to direct a flow of air into the main chamber to entrain debris; a manifold in communication with the nozzle, with one end of the manifold including an input portion to receive pressurized air; a first front skirt, the first front skirt positioned adjacent to and substantially coextensive with the main chamber, the first front skirt selectively movable between a first position and a second position;

a debris receptacle; and,

a debris conveyer operatively connecting the head assembly to the debris receptacle;

wherein an air stream with entrained debris is conveyed from the output portion of the head assembly to the debris receptacle, debris-separated and conveyed to the input portion of the head assembly.

2. The air sweeping system of claim 1, further comprising a second front skirt, the second front skirt adjacent to and in spaced relation in front of the first front skirt, the second front skirt substantially coextensive with the main chamber and extending from the head assembly to a surface to be swept.

3. The air sweeping system of claim 1, further comprising a first rear skirt, the first rear skirt positioned adjacent to and substantially coextensive with the main chamber, the first rear skirt extending from the head assembly to a surface to be swept.

4. The air sweeping system of claim 1, wherein a portion of the air stream that is conveyed toward the input portion of the head assembly is directed back into the debris receptacle for further filtering and then exhausted to the atmosphere.

5. An air sweeping system for removing debris from a surface, the system comprising:

a head assembly having a main chamber for debris pick-up having a substantially curvilinear interior surface and a longitudinal axis, the main chamber having an outlet portion; a nozzle configured to direct a flow of air into the main chamber to entrain debris; a manifold in communication with the nozzle, with one end of the manifold including an input portion to receive pressurized air; a first front skirt, the first front skirt positioned adjacent to and substantially coextensive with the main chamber, the first front skirt selectively movable between a first position and a second position;

a debris receptacle for receiving debris; and,

a debris conveyer operatively connecting the head assembly to the debris receptacle; wherein an air stream with entrained debris is conveyed from the output portion of the head assembly to the debris receptacle, filtered and conveyed to the input portion of the head assembly.

6. The sweeping system of claim 5, wherein the air flow directed into the main chamber by the nozzle is generally transverse to the longitudinal axis of the main chamber.

7. The sweeping system of claim 5, wherein the air flow directed into the main chamber is skewed with respect to the direction of motion of the head assembly over a surface being cleaned.

8. The sweeping system of claim 5, wherein the main chamber is skewed with respect to the direction of motion of the head assembly over a surface being cleaned.

9. The sweeping system of claim 5, wherein the debris conveyer includes a debris conduit having a variable cross-sectional area along at least a portion of its length to diffuse the air stream as it moves therealong.

10. The sweeping system of claim 5, wherein the debris receptacle includes a plurality of bins, with the plurality of bins including a plurality of discharge openings, and wherein the debris receptacle includes a movable panel configured to be positioned in sealing relation to at least one of the plurality of discharge openings.

11. A head assembly for use in conjunction with a debris conveyer and a debris receptacle of an air sweeping apparatus, the head assembly comprising:

- a main chamber for debris pick-up having an outlet portion;
- a nozzle configured to direct a flow of air into the main chamber;
- a manifold in communication with the nozzle, with one end of the manifold including an input portion to receive pressurized air; and,
- a first front skirt, the first front skirt positioned adjacent to and substantially coextensive with the main chamber, the first front skirt selectively movable between a first position and a second position.

12. The assembly of claim 11, wherein the main chamber has a substantially curvilinear interior surface.

13. The assembly of claim 12, wherein the interior surface is ovate.

14. The assembly of claim 11, the nozzle extends along the main chamber.

15. The assembly of claim 11, wherein the nozzle is an air knife.

16. The assembly of claim 11, wherein the main chamber is skewed with respect to the direction of motion of the head assembly.

17. The assembly of claim 16, wherein the nozzle extends along the main chamber, and wherein the nozzle is substantially parallel in relation thereto.

18. The assembly of claim 11, wherein the nozzle is skewed with respect to the direction of motion of the head assembly.

19. The assembly of claim 11, further including an actuator operatively connected to the first front skirt for selective movement thereof between the first position and the second position.

20. The assembly of claim 11, further comprising a second front skirt, the second front skirt positioned adjacent to and in spaced relation in front of the first front skirt, the second front skirt substantially coextensive with the main chamber and extending from the head assembly to a surface to be swept.

21. The assembly of claim 11, further comprising a first rear skirt, the first rear skirt positioned adjacent to and substantially coextensive with the main chamber, the first rear skirt extending from the head assembly to a surface to be swept.

22. The assembly of claim 21, further comprising a second rear skirt, the second rear skirt positioned adjacent to and in spaced relation behind the first rear skirt, the second rear skirt substantially coextensive with the main chamber and extending from the head assembly to a surface to be swept.

23. The assembly of claim 11, the main chamber further including a barrier positioned inwardly from one side of the chamber to define a recovery chamber, the recovery chamber in communication with the outlet portion of the head assembly.

24. The assembly of claim 23, the barrier further including a stop for limiting the movement of the first front skirt.

25. The assembly of claim 22, further comprising side skirts positioned at either side of the head assembly and between the first and second front skirts.

26. The assembly of claim 11, wherein the first front skirt is flexible.

27. The assembly of claim 11, wherein the first front skirt is in substantially parallel relation with the main chamber.

28. The assembly of claim 27, wherein the second front skirt is in substantially parallel relation with the main chamber.

29. A debris receptacle for use in conjunction with a debris conveyor in an air sweeping apparatus, the receptacle comprising:  
a plurality of wall portions defining a substantially closed chamber;  
a movable panel, the movable panel configured to be positioned in sealing relation to the chamber; and  
a first partition and a second partition, the partitions defining a first bin, a second bin, and a third bin, the first bin having a debris inlet port, the second bin in communication with the first bin, the second bin including a separator having an intake aperture, a debris aperture and an exhaust, the exhaust in communication with a debris conveyer, the third bin including a bypass port for receiving an air stream from a bypass conduit.

30. The debris receptacle of claim 29, wherein the separator is a centrifugal separator.

31. The debris receptacle of claim 30, wherein the centrifugal separator includes an exhaust air stream which is coupled via an extension element to a low pressure end of the debris

conveyer, and wherein the extension element includes an aperture providing air communication between the exhaust air stream and the second bin.

32. The debris receptacle of claim 29, wherein the first, second and third bins include discharge openings which are adjacent to each other and accessible through the movable panel.

33. The debris receptacle of claim 29, further comprising a first filter element operatively positioned between the first and second bins and configured to prevent debris larger than a first predetermined size from entering the second bin.

34. The debris receptacle of claim 33, further comprising a second filter element operatively positioned adjacent to a section of the third bin and configured to prevent debris larger than a second predetermined size from being exhausted into the atmosphere.

35. A debris receptacle for use in conjunction with a debris conveyor in an air sweeping apparatus, the receptacle comprising:

a first bin having a low pressure debris conduit port and a second bin in communication with the first bin, the second bin including a separator having an intake aperture, a debris aperture and an exhaust, the exhaust in communication with a debris conveyer, with the first and second bins having adjacent discharge openings which are accessible through a movable panel.

36. The debris receptacle of claim 35, wherein the discharge openings of the first and second bins are substantially coplanar.

37. A debris receptacle of claim 35, further comprising:

a third bin having a bypass port for receiving an air stream from a bypass conduit and a discharge opening, with the discharge opening adjacent the discharge openings of the first and second bins; wherein the first, second and third discharge openings are accessible through the movable panel.

38. The debris receptacle of claim 37, wherein the discharge openings of the first, second and third bins are substantially coplanar.

39. A method for removing and collecting debris from a generally horizontal surface, the method comprising the steps of:

forming an air stream into a substantially horizontally aligned vortex;  
entraining debris within the vortex by drawing the vortex thereover;  
conveying the debris from the vortex to a first bin;  
removing in the first bin a debris larger than a first predetermined size from the air stream;

conveying the air stream into a second bin;  
separating in the second bin some of the remaining debris from the air stream; and  
conveying the air stream back to the vortex.

40. The method of claim 39, wherein the step of conveying the debris from the vortex to the first bin includes the step of diffusing the air stream.

41. The method of claim 39, wherein the step of removing debris larger than a first predetermined size from the air stream includes the step of:

directing the air stream through a first filter element.

42. The method of claim 39, further including the step of:

directing a portion of the air stream being conveyed back to the vortex into a third bin;

43. The method of claim 42, further including the steps of:

removing in the third bin debris larger than a second predetermined size from air stream;

and,

exhausting an air stream from the third bin into the atmosphere.

44. The method of claim 43, wherein the step of removing debris larger than a second predetermined size from the air stream includes the step of:

directing the air stream through a second filter element.

45. A head assembly for use in conjunction with a debris conveyer and a debris receptacle of an air sweeping apparatus, the head assembly comprising:

a main chamber for debris pick-up having a front end, a rear end, opposing sides, an input portion and an outlet portion;

a nozzle, the nozzle operatively connected to the input portion and configured to direct a flow of air into the main chamber;

a first front skirt positioned adjacent to and substantially coextensive with the front end of the main debris pick-up chamber;

a first rear skirt positioned adjacent to and substantially coextensive with the rear end of the main debris pick-up chamber; and,

a barrier, the barrier positioned adjacent to and inwardly with respect to one of the sides of the main debris pick-up chamber, the barrier and the one side of the main debris chamber forming a recovery chamber; wherein,

the barrier and the recovery chamber operate in concert to direct entrained debris into the output portion of the main debris pick-up chamber to reduce dusting and trailing.

46. The assembly of claim 45, wherein the main debris pick-up chamber has a cross-sectional area, and wherein the barrier is substantially the same size as the said cross-sectional area.

47. A head assembly for use in conjunction with a debris conveyer and a debris receptacle of an air sweeping apparatus, the head assembly comprising:

a main debris pick-up chamber having a front end, a rear end, opposing sides, an input portion and an outlet portion;

a nozzle, the nozzle operatively connected to the input portion and configured to direct a flow of air into the main chamber;

a first front skirt positioned adjacent to and substantially coextensive with the front end of the main debris pick-up chamber;

a first rear skirt positioned adjacent to and substantially coextensive with the rear end of the main debris pick-up chamber; and,

a pair of side skirts, the side skirts positioned in opposing relation and in front of the first front skirt; wherein,

the side skirts direct entrained debris towards the main debris pick-up chamber to reduce trailing and dusting.

48. A head assembly for use in conjunction with a debris conveyer and a debris receptacle of an air sweeping apparatus, the head assembly comprising:

a main debris pick-up chamber having a front end, a rear end, opposing sides, an input portion and an outlet portion;

a nozzle, the nozzle operatively connected to the input portion and configured to direct a flow of air into the main chamber;

a first front skirt positioned adjacent to and substantially coextensive with the front end of the main debris pick-up chamber;

a first rear skirt positioned adjacent to and substantially coextensive with the rear end of the main debris pick-up chamber; and,

a scavenger strip positioned adjacent to and extending forwardly from the first rear skirt;  
wherein,

the scavenger strip directs entrained debris towards the main debris pick-up chamber to  
reduce trailing and dusting.

49. A head assembly for use in conjunction with a debris conveyer and a debris  
receptacle of an air sweeping apparatus, the head assembly comprising:

a main debris pick-up chamber having a front end, a rear end, opposing sides, an input  
portion and an outlet portion;

a nozzle, the nozzle operatively connected to the input portion and configured to direct a  
flow of air into the main chamber;

a first front skirt positioned adjacent to and substantially coextensive with the front end of  
the main debris pick-up chamber;

a first rear skirt positioned adjacent to and substantially coextensive with the rear end of  
the main debris pick-up chamber;

a barrier, the barrier positioned adjacent to and inwardly with respect to one of the sides  
of the main debris pick-up chamber, the barrier and the one side of the main debris chamber  
forming a recovery chamber;

a pair of side skirts, the side skirts positioned in opposing relation and in front of the first  
front skirt; and,

a strip, the strip positioned adjacent to and extending forwardly from the first rear skirt;  
wherein, the barrier, the side skirts and the strip direct entrained debris towards the main debris  
pick-up chamber to reduce trailing and dusting.